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Survivability/Vulnerability Information Analysis Center

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SURVIAC Survivability Analysis Workshop 2000

Prof. Robert Ball

The Experts

Report Documentation Page

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Survivability Analysis Workshop 2000

SURVIAC planned and hosted a Survivability Analysis Workshop on 25-29 September 2000 at Wright-Patterson Air Force Base, Ohio. This week long workshop was sponsored by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS). Expert presenters on various aspects of survivability were drawn from the government, civilian, military, industry, and academia. Each of the Services were represented as well as the Office of the Secretary of Defense (OSD).

The workshop was well grounded in the fundamentals of survivability. This was assured by the first day presenter, Robert E. Ball, Distinguished Professor Emeritus, Naval Postgraduate School. Professor Ball literally wrote the book on survivability. His textbook entitled "The Fundamentals of Aircraft Combat Survivability Analysis and Design" set the standards for all survivability studies. Professor Ball has long taught survivability; his presentation, expertise, and style reflect the skill of this master teacher. Professor Ball is currently working on a second edition of his book. The workshop attendees received the benefit of his most recent work as Professor Ball gave an overview of the survivability discipline. He defined terminology and explained concepts to establish the common baseline for the rest of the workshop.

Prof. Robert Ball shares his expertise.

The subsequent days of the workshop then built on this foundation covering specific topics in greater detail. On Tuesday, susceptibility analysis was covered. Susceptibility is analogous to the probability of getting hit. Susceptibility analysis includes signature and detection, flight path and tactics, and a wide variety of electronic countermeasures and counter-countermeasures. These topics were presented by Mr. Steve Ames (ASC/ENMM), Mr. Donald Sedor (ASC/EF), Messrs. Michael Bennett and Kevin Crosthwaite (SURVIAC).

On Wednesday all aspects of vulnerability analysis were presented. Vulnerability analysis concerns surviving being killed given a hit occurs. Vulnerability analysis includes fuzing, geometric targets, shotline penetration, blast, fire, and endgame. These topics and models used to analyze them were described in detail by Mr. Ron Dexter and Ms. LeAnne McKay (SURVICE Engineering Co.), Mr. Andrew Pascal (Enthalpy Corp.), Mr. Thomas Wasmund (NSWC-Dahlgren) and Messrs. Gerald Bennett and Kevin Crosthwaite (SURVIAC).

Thursday's session focused on combining susceptibility and vulnerability results into engagement analysis. Engagements are typically analyzed according to the type of threat including antiaircraft artillery, surface-to-air missiles, lasers, directed energy weapons and other aircraft both fixed and rotary wing. The models used to analyze these engagements were discussed by Captain Jonathan Fitton (453rd EWS), LtCol Julie Jacobson (DIA-ASC/SMJ), Mr.

Workshop continued on page 9

Advanced Joint Effectiveness Model (AJEM) 1.0 Released

By Tom Wasmund

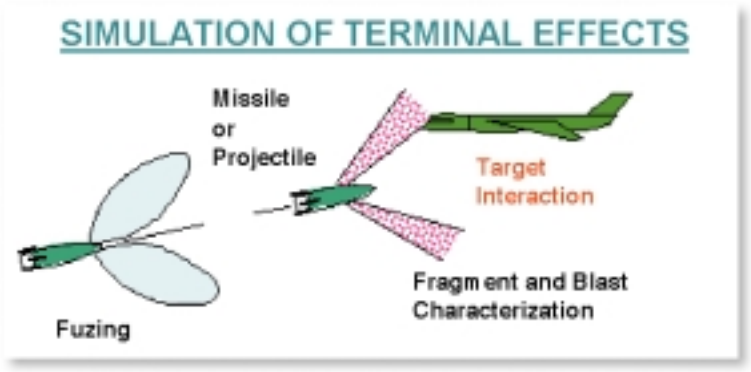


Figure 1. What Happens When You Get Hit?

The recent release of AJEM 1.0 gives both the platform vulnerability/survivability analyst and the munition lethality/effectiveness analyst a new tool with new capabilities that can provide more realistic estimates of survivability and effectiveness. AJEM can be used to evaluate all conventional ballistic threats against aircraft, missile, and ground-mobile targets. It combines the capabilities of a number of models that it will replace including the COVART vulnerability/lethality model and the JSEM endgame model, and adds considerable more.

AJEM can provide more realistic predictions primarily because it traces the actual threat path through a target and calculates the vulnerability/lethality on the fly rather than use precalculated vulnerability data and interpolated results. It can be used for evaluating a single threat against a single target or multiple threats versus single or multiple targets. In the case of multiple threats, target damage data is realistically accumulated and the results are assessed after all threats have hit the target; current models incorrectly assume an undamaged target with each additional threat. In addition AJEM has new target interaction capa-

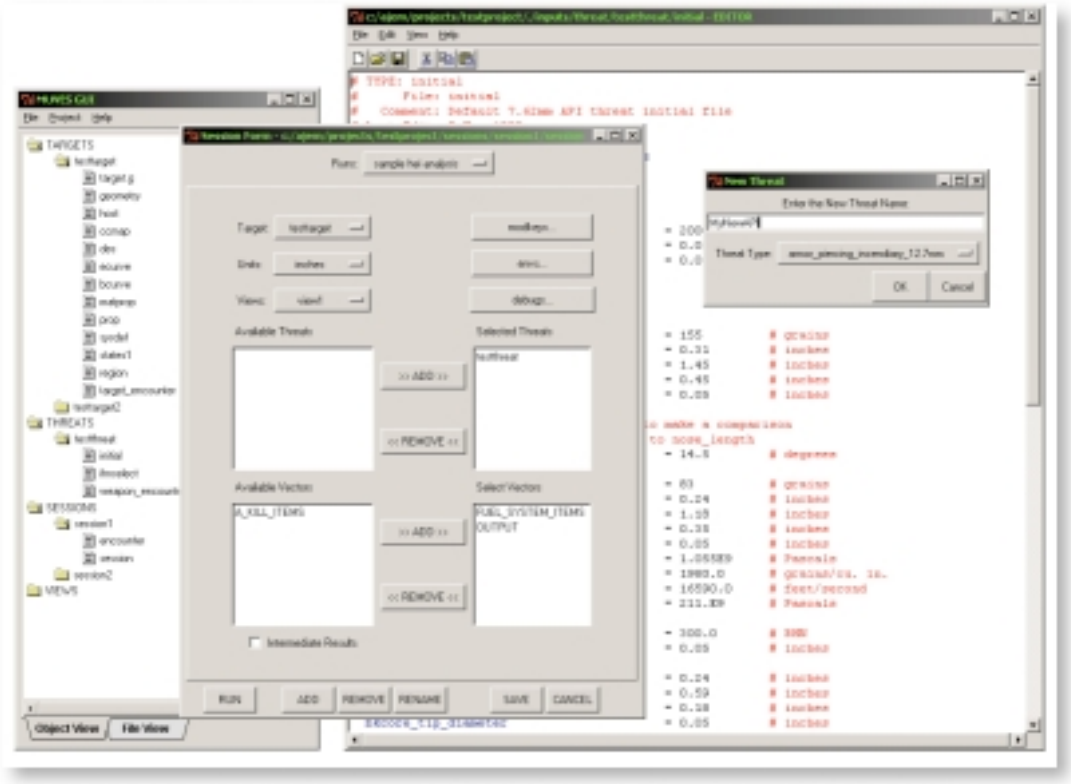


Figure 2. The AJEM 1.0 User Interface.

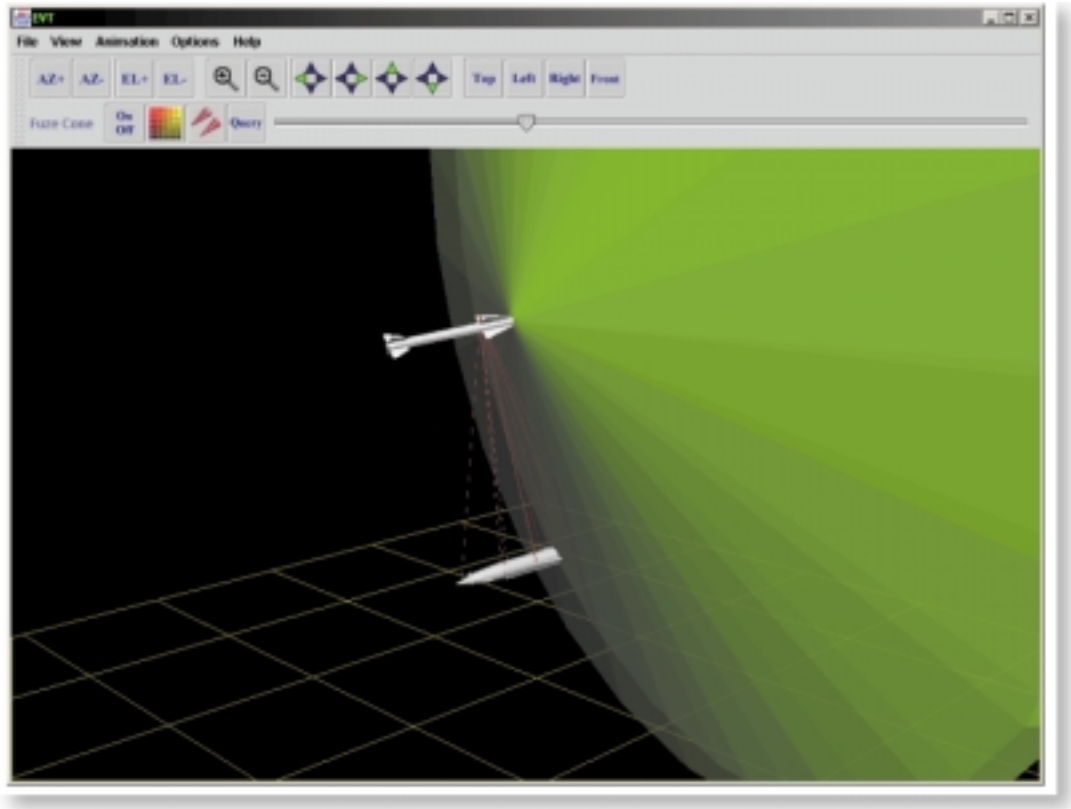


Figure 3. AJEM Encounter Visualization Tool (EVT).

bilities for HEI projectiles, fragment and rod penetrators, and direct hit missiles that are not available in other models.

A major advantage to the AJEM user is that all endgame and target-interaction calculations work with the same BRL-CAD target geometry. Further, the recent release of BRL-CAD 5.1 includes complete FASTGEN primitive support - and the AJEM User Interface is designed to support FASTGEN files and seamlessly convert to BRL-CAD format behind the scenes. A converter is also included to convert existing COVART input files into AJEM format.

AJEM's software structure consists of three separate modules. Each module is distinct and runs as a separate process in a UNIX environment. These modules are:

- The AJEM Graphical User Interface (GUI),
- The AJEM Encounter Module, and
- The AJEM Vulnerability/Lethality (V/L) Module.

These separate processes communicate with each other and share common data files that contain information about the target description and threat, as well as output from an analysis. The AJEM user interface (shown in Figure 2) aids the analyst in managing the various input files required for an assessment, and controls the operation of the Encounter and V/L Modules. It provides on-line access to detailed documentation and references in HTML format, including sample cases with input files. The documentation is also linked to the actual source code for further understanding of the model and its processes. The GUI provides access to a number of tools including a dynamic, color-coded text file editor, a final results postprocessor, a vulnagram utility, an Encounter Visualization Tool (EVT), (Figure 3) and the BRL-CAD modeling and visualization tool MGED. Both the AJEM and MGED interfaces are Tool Command Language and Toolkit (Tcl/Tk) based windowing programs rather than hardware dependent graphic routines. This allows the user to reconfigure the windows to suit individual preferences by cre-

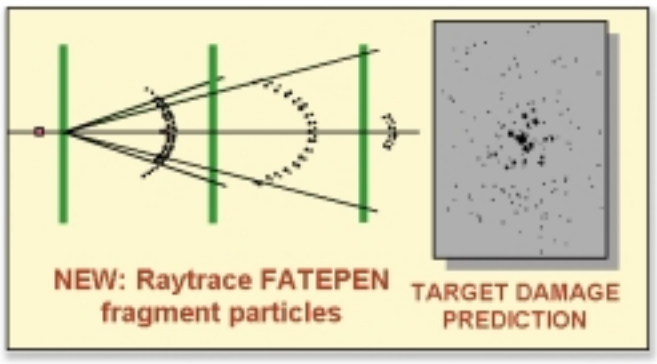
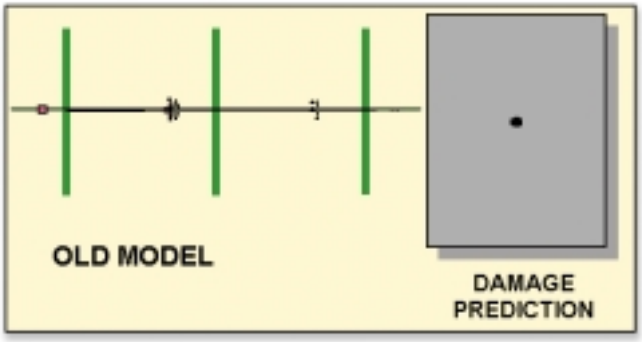


Figure 4. FATEPEN Damage Prediction Compared With Current Capability.

ating and using Tcl/Tk scripts; it also provides access to all of the BRL-CAD tools.



The Encounter Module is a separate endgame program that models the terminal kinematics of an engagement between a missile and a target. It can be executed in a stand-alone mode or via the AJEM user interface. It has an internal fuze model and also has the capability to use various system-specific fuze models that interact with the BRL-CAD target description to predict warhead burst points. Once the burst points are determined, the option is provided to run the V/L Module to determine target Pk. The Encounter Visualization Tool (EVT) can read the input and output of the Encounter Module and animate the encounter to assist the analyst in visualizing the results of a run.

Figure 3 shows a missile encounter with a missile target, and displays the fuze cone and fragment traces, emanating from the warhead at the burst point.

At the heart of AJEM is its V/L Module. It provides all of the target interaction models for API and HEI projectiles, fragments, blast, shaped charges, KE penetrators, and missile body hits. The V/L module can be run alone to calculate conventional target vulnerable area, or it can be run in conjunction with the Encounter Module to calculate a Pk from warhead effects after a burst-point has been determined.

Some of the V/L Module interaction models provide more realistic predictions than previous models. For example, the HEI model raytraces each fragment path through the target and can be run stochastically. It also allows for attenuation of blast and combined effects by intervening target components. The FATEPEN penetration and damage model allows the realistic analysis of fragments, projectiles, and long rods. It includes penetrator orientation and tumbling, path deflection, ricochet, and the tracing of fragment debris particles off the main penetrator shotline. A comparison of predicted fragment damage from this new model compared with the old capability is shown in Figure 4 - the results can be significantly different. The missile direct hit model calculates the defeat of individual components linked to fault trees rather than declaring the target killed or not killed, as in current models - another more realistic improvement.

AJEM uses the U.S. Army Research Laboratory Modular Unix-based Vulnerability Estimation Suite (MUVES) as the V/L Module. MUVES provides the

AJEM continued on page 9

Advanced Low Altitude Radar Model (ALARM) 4.2 Now Available

SURVIAC is pleased to announce distribution of the newest version of ALARM (Version 4.2) completed in August 2000. ALARM (Advanced Low Altitude Radar Model) is a generic digital computer simulation designed to evaluate the performance of a ground-based radar system attempting to detect low altitude aircraft. It is an integration period model (i.e., the detection performance of the radar is determined over one integration period), and radar detection calculations are based on the signal-to-noise (S/N) radar range equations commonly used in radar analysis. The purpose of ALARM is to provide a radar analyst with a software simulation tool to evaluate the detection performance of a ground-based radar system against the target of interest in a realistic environment. The ALARM detection results include the effects of pulsed/Moving Target Indicator (MTI) or pulsed Doppler (PD) filtering for reduction of clutter returns. ALARM also has a limited capability to model continuous wave (CW) radar. Additionally, ALARM models onboard noise (self-screening) jammers, onboard deception (coherent) jammers, and standoff noise jammers. ALARM is strictly a one-aircraft-on-one radar model; however, one-on-one results may be combined to perform a one aircraft-on-many analysis. Actual two- or three-dimensional radar antenna gain pattern data can be loaded. Multiple beam radar can also be simulated by making separate runs for each beam and then combining their results using a support program.

ALARM represents the radar, target, and environment with multiple components. The radar is comprised of its transmitter, antenna, receiver and signal processor. The target is comprised of its flight characteristics and RCS. The environment is comprised of terrain, clutter, pattern propagation factor, atmospheric attenuation, and jammers. The primary application of ALARM is the evaluation of target detection range as a function of the environment. The model includes the environmental effects through the use of Joint Technical Coordinating Group on Aircraft Survivability Common Modeling Component Set (JTCG/AS CMCS). Land clutter reflectivity probability distributions, published by Massachusetts Institute of Technology (MIT) Lincoln Laboratory, and sea clutter reflectivity probability, distribution from the Center for Naval Analyses (CNA), are also used in ALARM. Additionally, pattern propagation effects are included by use of the MIT Lincoln Labs Spherical Earth/Knife Edge (SEKE) Diffraction source code. Finally, terrain masking is determined based on National Imagery and Mapping Agency (NIMA) data input to the model for a specific radar site area.

ALARM can operate in the following modes; flight path analysis (FPA), horizontal detection contour (HDC), vertical coverage envelope (VCE), and vertical detection contour (VDC). FPA mode is used to model specific flight data parameters, and detection is determined for each data point. HDC mode is used to generically illustrate a radar's detection performance in which multiple north to south straight line flight paths are generated from left to right across the radar site, and the aircraft flies straight and level. VCE represents the radar's outer most detection capabilities for round smooth earth cases and automatically disables target Doppler, eclipsing, clutter, and terrain masking effects. VDC mode computes the radar's detection contour, analogous to the HDC mode in the vertical plane and does not automatically disable any effects.

For ALARM Version 4.2, many of the radar and simulation support functions or components utilized in previous versions

ALARM 4.2

of ALARM have been replaced by functions from the JTCG/AS CMCS. The implementation of SEKE in the common environment propagation component is based on the original SEKE source code with the same subroutines and functions used; however, they were rewritten to more closely follow the FORTRAN90 standard and the programming style of EARCE (ESAMS, ALARM, and RADGUNS Common RF (radio frequency) Environment).

ALARM Version 4.1 is not recommended to be installed over an existing version, and it is strongly recommended that the current ALARM installation be backed up before upgrading. Version 4.1 installation media contains all the files needed for a complete installation. New modifications incorporated into Version 4.1 include the following. ALARM has an added error check for the TARGET_TYPE input. In addition, the error checking was modified changing some warning messages to error messages which will cause termination of the run. This applies mostly to inputs having fixed array bounds (i.e. PD_BANDWIDTH and PRF). Initialization of elevation pointing angles in the VCE mode was also corrected. Furthermore, the initialization of dynamically allocated arrays in pd.f90 has been added. The PD_BANDWIDTH inputs will now be echoed to the '.out' file. The lat_lon_class is now modified to properly read latitude and longitude specifications containing fractional seconds. Finally, RhaChart, the post-processing support program, was modified to examine the detection flag in the VDC data diaries instead of comparing S/I (signal-to-interference) to the threshold; along with, an enhancement to place the maximum detection range and maximum detection altitude on the plots.

Enhancements in ALARM Version 4.0 include the following. ALARM was redesigned to be object-based making ALARM easier to run from other applications. Correspondingly, the PdMerge program was rewritten to be object-based. The ALARM input file format is more user friendly allowing for comments and combining variable names and white spaces to separate inputs from values. Version 4.0 incorporated the enhanced version of the JTCG/AS CMCS Environment Component for modeling atmospheric attenuation, antenna, clutter reflectivity, electromagnetic propagation (multipath and diffraction), refraction, and terrain masking. Moreover, ALARM will utilize standardization of both RCS and Random Number Generator to ensure consistent comparable results. Two simulation types, VCE and VDC, were added. FpaChart, HdcChart, and RhaChart are additional post-processing support programs. The GENANT, DIMENS, DMABIO, DMABIOCD, BINPRO, PREPGP, and GRAPHIT support programs have been removed. Finally, two utilities were added to read existing ALARM 3.x input files and transform them into the revised ALARM 4.0 format.

To order ALARM 4.2, please contact Mrs. Geri Bowling at SURVIAC, Com: (937) 255-4840, DSN: 785-4840, or by E-mail at gbowling@bah.com

Upcoming Model Meetings

The following is a list of upcoming model meetings. For more information on these meetings, please contact Mr. Paul Jeng, Booz·Allen & Hamilton Inc., Com: (937) 431-2712 or by E-mail: surviacmodels@bah.com. Also, visit our web site at: *http://iac.dtic.mil/surviac.*

JMASS Users Conference
30 April - 3 May 2001
Wright-Patterson AFB, Ohio

JMUM 2001
19-22 June 2001
Colorado Springs, Colorado

ESAMS, BRAWLER, DIME Meeting
19-22 June 2001
Colorado Springs, Colorado

Survivability Workshop continued from page 3

Attendees refer to their notebooks provided at the workshop.

Randyll Levine ASC/HPMT), Mr. Larry Taranto (ASC/ENMM), Mr. John Tatum (Army Research Lab.), Ms. Linda Hamilton and Messrs. Gerald Bennett and Michael Bennett (SURVIAC).

On the final day of the workshop, all of the previous topics were rolled up into mission and campaign analysis. In addition, other key survivability topics were briefed such as aircraft battle damage repair, analysis of alternatives, as well as specific aspects of ground vehicle and rotary-wing aircraft survivability. Key government agencies that influence survivability were discussed including the Joint Technical Coordinating Groups for Aircraft Survivability (JTCG/AS) and Munitions Effectiveness (JTCG/ME) and the Directorate Operational Test & Evaluation/Live Fire Testing (DOT&E/LFT). Presenters on this last day included LCDR R. Douglas Buchy (JMASS PO), Messrs. Mark Butkiewicz and Ron Dexter (SURVICE Engineering Co.), Mr. Robert Meyer (NAWC-ASC/SMJ), Mr. Ernest Timmie (OSU-Eglin), Mr. Robert Wojciechowski, Jr. (OSD DOT&E/LFT), Mr. Donald Voyls (46th Test Wing), Mr. Michael Weisenbach (JTCG/AS), and Messrs. Kevin Crosthwaite and Michael Miles (SURVIAC)

All in all, over 45 separate briefings were presented to the workshop attendees. The evaluation sheets showed that 31 of these briefings were listed as someone's favorite. Overall, the attendees evaluated the workshop as excellent with an appropriate level of detail. An overwhelming majority indicated that they would recommend this course to coworkers. Each attendee received a notebook and a CD with all the presentations for use as future reference.

SURVIAC would like to thank both the attendees and speakers for making this workshop possible and successful. The workshop provided a definite value to the community and reflects credit on the sponsoring agency JTCG/AS.

For more information on the Survivability Analysis Workshop and how to obtain a CD or notebook of presentations, please contact SURVIAC at (937) 255-4840 or DSN: 785-4840.

AJEM Continued from page 6

capability to add new physics-based target interaction models, such as FATEPEN, as linked libraries. One of the new capabilities being developed that will be in a new version of AJEM is a dynamic external blast model, BEAMS. A new capability is also being added to FATEPEN to predict penetration and fuzing of Man Portable Air Defense Systems (MANPADS). A baseline MANPADS capability already exists in the developmental AJEM version 1.1.

The AJEM 1.0 Package is available on CD-ROM from the SURVIAC Aberdeen Satellite Office with full-service support. For more information, visit the AJEM website at www.ajem.com or contact Ms. Lisa Garriques at the SURVIAC Aberdeen Satellite Office, (410) 273-7722 or E-mail: lisa@survice.com. The model User MOA is available for downloading from the website.

SURVIAC Product Availability

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Products

Product	Classification	Reproduction & Handling Fee
A Critical Review of Graphite Epoxy Laser Damage Studies	SECRET	$ 50.00
A Summary of Aerospace Vehicle Computerized Geometric Descriptions for Vulnerability Analyses	Unclassified	$100.00 (Free to Gov't)
Advanced Materials for Enhanced Survivability	SECRET	$100.00
Aircraft Fuel System Fire and Explosion Suppression Design Guide	Unclassified	$150.00/3 Volumes
'Aircraft Survivability' Video	Unclassified	$ 50.00 or 30-Day Loan
Alternatives For Halon 1301 In Army Ground Vehicle Firefighting Systems	Unclassified	$250.00
An Overview of Laser-Induced Eye Effects	SECRET	$150.00
An Overview of Laser Technology and Applications	Unclassified	$ 50.00
'Battle Damage Repair of Composite Structures' Video	Unclassified	$ 75.00
Collection of Vulnerability Test Results for Typical Aircraft Systems and Components	CONFIDENTIAL	$150.00
Comparative Close Air Support Vulnerability Assessment Study - Executive Summary	SECRET	None (Gov't. Only)
Compendium of References for Nonnuclear Aircraft Survivability (A Supplement to MIL-HDBK-336)	Unclassified	$150.00
Component Vulnerability (Pd/h) Workshop Component Pd/h Handbook w/addendum	SECRET	$200.00 (Free to Gov't)
Component Vulnerability Database Development - CD	SECRET	$100.00 (Free to Gov't)
Countermeasures Handbook for Aircraft Survivability (3 Volumes)	SECRET	$200.00 (Free to Gov't)
Critical Review and Technology Assessment (CRTA) for Soldier Survivability (SSv)	Unclassified	$ 50.00
'Designing for Survivability' Video	Unclassified	30-Day Loan
Gas Explosion Suppression Agent Investigation	Unclassified	$200.00
Gun and Missile Pedigree Threat Reports - CD	SECRET	$150.00
Joint Live Fire/Live Fire Test Program Catalogue, Version 3.1	Unclassified	$ 95.00
MANPADS Threat to Aircraft: A Vulnerability Perspective - Final Report	SECRET	$200.00
Model User Group Meeting Minutes - CD	Unclassified	$ 50.00
National MANPADS Workshop: A Vulnerability Perspective Proceedings 2 Volumes	SECRET	$200.00
Penetration Characteristics of Advanced Engine Materials	Unclassified	$100.00
Proceedings of the Eighth DOD Conference on DEW Vulnerability, Survivability and Effects - 2 Volumes	SECRET	$125.00/Per Set
RADGUNS 1.8 Parametric Study	SECRET	$100.00 (Free to Gov't)
Ship Survivability Overview	Unclassified	$ 50.00
'SURVIAC - A Capabilities Overview' Video	Unclassified	30-Day Loan
Survivability ANalysis Workshop Notebook - 2000	Unclassified	$100.00 (Free to Gov't)
Survivability Systems Master Plan	Unclassified	$ 50.00 (Free to Gov't)
Testing of Aircraft or Aircraft Surrogates with On-Board Munitions	Unclassified	$100.00
"Threat Effects in Aircraft Combat Survivability" Video	Unclassified	$150.00 or 60-Day Loan
Ullage Explosion Hazard State-of-the-Art Report (SOAR)	Unclassified	$ 50.00
Unmanned Aerial Vehicles Survivability Compendium—Interim Report Database	Unclassified	$200.00
U.S. Air Force Surface-To-Air Engagements During Operation Desert Storm	SECRET	$100.00 (Free to Gov't)
Vulnerability Reduction Design Guide for Ground Systems in a Conventional Combat Environment	Unclassified	$200.00

For further information on how to obtain these products and how to establish need-to-know certification, please contact SURVIAC at (937) 255-4840 or DSN 785-4840. Requests from non-U.S. agencies must be forwarded to their country's Embassy in Washington DC, Attn: Air Attache's Office.

SURVIAC Model Availability

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Model	Classification	Reproduction & Handling Fee	
		Model	Documentation
MIL-AASPEM — Man-in-the-Loop Air-To-Air System Performance Evaluation Model	Unclassified	$500.00	$ 80.00+
AIRADE—Airborne Radar Detection Model	Unclassified	$500.00	$ 36.00
ALARM—Advanced Low Altitude Radar Model	Unclassified	$500.00	$ 60.50+
BLUEMAX IV—Variable Airspeed Flight Path Generator	Unclassified	$500.00	$ 15.00+
BRAWLER—Air-To-Air Combat Simulation	SECRET	$500.00	$231.50+
BRL-CAD—Ballistic Research Laboratory Computer-Aided Design Package*	Unclassified	$500.00	N/A
COVART—Computation of Vulnerable Area and Repair Time	Unclassified	$500.00	$ 37.00
DIME—Digital Integrated Modeling Environment	Unclassified	$500.00	$ 63.00
ESAMS—Enhanced Surface-To-Air Missile Simulation	SECRET	$500.00	$295.50+
FASTGEN—Fast Shotline Generator	Unclassified	$500.00	$ 52.00
IVIEW 2000—Graphical User Interface for Output Simulation	Unclassified	$100.00	+
JSEM - Joint Service Endgame Model	Unclassified	$500.00	TBA*
LELAWS—Low Energy Laser Weapons Simulation	Unclassified	$500.00	$ 31.50
RADGUNS—Radar-Directed Gun System Simulation	SECRET	$500.00	$ 69.50+
TRAP—Trajectory Analysis Program	Unclassified	$500.00	$256.00
TRACES—Terrain/Rotorcraft Air Combat Evaluation Simulation	Unclassified	$500.00	$127.00

* For more information regarding BRL-CAD or JSEM documentation, contact Mr. Bob Strausser at the SURVIAC Aberdeen Satellite Office, (410) 273-7722.

+ Documentation included with code on CD version of Model at no charge

Models

For further information on how to obtain these models and how to establish need-to-know certification, please contact SURVIAC at (937) 255-4840 or DSN 785-4840. Requests from non-U.S. agencies must be forwarded to their country's Embassy in Washington DC, Attn: Air Attache's Office.

EARCE Now Available from SURVIAC

SURVIAC is pleased to announce distribution of the newest version of EARCE (ESAMS, ALARM, and RADGUNS Common Environment), Version 2.2, completed in July 2000. The ESAMS, ALARM, and RADGUNS (EAR) models are a major portion of the Tri-Service survivability codes distributed by SURVIAC. The JTCG/AS sponsored an effort to develop Common Radio Frequency (RF) Modeling Components (CE) for the EAR models as a part of a Common Model Component Set (CMCS), of which the CE is a subset. Development of the CE has been a joint effort with participants from the Air Force, Army, Navy, and National Ground Intelligence Center. The purpose of the Common Environment Modeling Component Set (CEMCS) is to provide a means of standardizing algorithms and software common to the EAR RF models. This standardization will provide consistency in the environment, target, and statistical modeling of models utilizing the CEMCS. Currently, the CEMCS consists of six components: antenna, atmospheric attenuation, clutter, propagation, refraction, and terrain. While components can be logically viewed as individual entities, they may in fact be aggregates of lower-level components. The antenna (antenna file and antenna pattern) and terrain (terrain cell and IJ stack) components are two such examples.

The work is being accomplished over three phases. Phase-1 is completed and provides CE sub-components for atmospheric attenuation, antennas, multipath propagation and clutter reflectivity. Phase-2 is currently under way and will provide improvements to the initial sub-components as well as provide additional sub-components to model refraction and terrain. At the end of Phase-2, a full CE will be achieved for use by the coalition models together with models having similar RF environment requirements. Phase-3 will provide a full up, high fidelity RF environment, not only for the future EAR type models, but any model requiring similar levels of fidelity for RF environment propagation effects.

The modifications incorporated into the EARCE V2.2 software include:

• The off-axis antenna pattern extrapolation algorithm was corrected.

• The lin2db function was modified to use the min_db parameter instead of a hard coded minimum value.

• Added a missing comma in a format statement that some compilers didn't catch.

• Modified r8_check_range and r8_zero_check in the error_check module to use a format specifier to give more precision. Changed from 'F' specifiers to 'G' specifiers.

• Removed the "echo" subroutines from antenna_file and antenna_pattern classes: echo_antenna_pattern, echo_antenna_cut, echo_data, echo_antenna_files, echo_antenna_file, set_antenna_echo_flag, and echo_data.

• Added limit checks for the CLUT_REFLECTIVITY and CLUT_DELTA_REFLECT inputs in the errcheck_clutter subroutine in the clutter class.

• Corrected echoing of LAND_COVER and LAND_FORM in echo_clutter when the CLUT_STATISTIC was set to numerical.

• Corrected the units in the declaration comment for sigclt clutter_signal_clut.

• Modified the atmospheric attenuation subroutine to return "zero" attenuation if the range to the target is less than or equal to the altitude increment. Previously it was possible to get some attenuation even when the target was on top of the radar.

SURVIAC Holds Annual Liaison Workshop

Liaison Attendees:

Larry Trost, Sandia National Labs
Bud Simrin, Lockheed
Robert Whittington, Patuxent River
Donna Egner, SURVIAC
Bill Serra, HQ AFMC
Tracy Sheppard, University of Texas
Robert Leach, Boeing
Kevin Crosthwaite, SURVIAC
Lt. Matthew Pixley (not pictured)

SURVIAC held it's 5th annual Liaison Workshop at Wright-Patterson AFB, Ohio 22-24 August 2000. In 1996, SURVIAC implemented an innovative liaison program to expand the survivability/vulnerability user base through the on-site training of Government and Industry volunteers. The purpose of the liaison training program is two-fold: the first objective is to increase user knowledge of SURVIAC, and what resources are available to support other agency's/company's mission. The second objective is to inform SURVIAC about the user's respective needs, in order to provide better support in the future.

For more information on attending future workshops, please contact Mrs. Donna Egner at (937) 255-4840, DSN: 785-4840, or by E-mail: degner@bah.com

EARCE continued from page 12

• Modified the gain_lookup subroutine in the antenna_pattern class to apply the minimum gain to 3D patterns.

• In the antenna_pattern class, removed the private subroutine get_rel_gain_pattern. For the private gain_lookup subroutine, the argument list was recorded and the txgmin variable was renamed to min_gain and the units were changed from dB to absolute. Eliminated the dB to linear conversion for minimum gain. The public interface to get_relative_gain remains unchanged.

• Corrected the echo_propagation subroutine to echo the setting of DIFFRACTION_SW.

• Corrected subroutines laprop and propagation_factor_prop in the propagation class to compute the correct propagation factor for all combinations of PROPAGATION_SW, DIFFRACTION_SW, and TERRAIN_SW.

• Added dynamic allocation of array indxmx in subroutine kediff. The mlocal parameter was removed.

• Corrected the bounds declaration of array elvmsl in subroutine second in the in the propagation class.

It is not recommended that EARCE V2.2 be installed over an existing version, and it is strongly recommended that the current EARCE installation be backed up before upgrading . The EARCE V2.2 installation media contains all the files needed for a complete installation. The EARCE 2.2 is available through SURVIAC. To request a copy of the EARCE, please call SURVIAC at DSN 785-4840 or (937) 255-4840.

Hit or Miss

"Hit or Miss"

An experiential learning program for Grades K through 8th

John Sparks, Det 1 AFRL/WSP

"Hit or Miss" is a Wizards-of-Wright K-8 educational outreach program sponsored by the Wright-Patterson Air Force Base Educational Outreach Office. The program utilizes a blue target board and Velcro-covered Ping-Pong balls to demonstrate the basic principles of probability, elementary use of fractions, the scientific method, and modern aircraft survivability. All four concepts are integrated together into one highly interactive learning experience. In the younger grades, the use of fractions is de-emphasized in favor of the concept of "chances" and basic counting.

Hit or Miss demonstration at Kaiser Middle School in Dayton, Ohio. Mr. John Sparks is wearing the "Wizards-of-Wright" lab jacket worn by all WPAFB S&E WOW Volunteers.

During the "Hit or Miss" demonstration, each student in the class is allowed to toss two or three balls at the blue target board (depending on class size). The total number of tosses for the entire class is tallied along with the corresponding numbers for hits and "kills." A kill is a hit on the target board within the red circular region (the bull's eye). The class repeats the ball-tossing experiment six times, the total number of class throws remaining constant throughout, for six different conditions that have influence on the total number of hits and kills. The class examines the potential influence due to distance, blindfolds, countermeasures, and armor applied to the bull's eye. Only one variable is changed each time the experiment is repeated, which allows the easy formulation of a hypothesis-whether the total number of hits/kills will go up or down-prior to actual experimentation. All six experimental results are discussed in light of the many methods that the modern United States Air Force uses to protect its airplanes while engaged in battle.

The Wizards-of-Wright "Hit or Miss" program can be accomplished in one action-packed fifty-minute class period in an ordinary-sized elementary classroom. An overhead projector and screen are required to show the accompanying slides. Desks and tables may need to be shuffled around a bit so a "throwing range" can be set up allowing tosses from both a 9-foot and 15-foot distance.

The Wizards-of-Wright "Hit or Miss" program is available on a per-request basis to public and private schools throughout the Miami Valley. To schedule the "Hit or Miss" program, contact the Wright-Patterson Air Force Base Educational Outreach Office at (937) 904-8622.

For more information contact Mr. John C. Sparks
Air Force Research Laboratory
(Det 1 AFRL/WSP)
Wright-Patterson AFB, Ohio 45433
Phone (937) 255-4782
E-mail: john.sparks@wpafb.af.mil

Calendar of Events

February

Space Technology and Application International
11-15 February 2001
Albuquerque, New Mexico
POC: Mary Bragg, (505) 833-0331

TechNet Tampa 2001
13-14 February 2001
Tampa, Florida
POC: B. J. Morrisette, (703) 631-6128, (800) 336-4583, ext. 6129, E-mail: bmorrisette@afcea.org

Impact of M & S Credibility on Acquisition, Test & Evaluation, Survivability, Lethality, and System Effectiveness
13-15 February 2001
Reno, Nevada
POC: Kathy Ernst, (760) 939-3681, E-mail: ernstka@navair.navy.mil

Practical Shock Analysis & Design
26 February - 2 March 2001
McLean, Virginia
POC: Mr. Joel Leifer, Booz·Allen & Hamilton Inc., (703) 289-5516

March

EW and SA for Survivability Symposium and Expo
13-15 March 2001
San Diego, California
POC: (301) 342-0026, E-mail: assenmachetj@navair.navy.mil

2001 Spring Interoperability Workshop
25-30 March 2001
Orlando, Florida
POC: Dr. Duncan Miller, (781) 981-7612, E-mail dmiller@II.mit.edu

US Army Ground Vehicle Survivability
26-29 March 2001
Monterey, California
POC: NDIA, Holly Mason, (703) 522-1820, E-mail: hmason@ndia.org

April

2001 AAAA Convention
4-7 April 2001
Charlotte, North Carolina
POC: AAAA, (203) 226-8184, E-mail aaaa@quad-a.org

May

Global Air and Space 2001
7-9 May 2001
Arlington, Virginia
POC: AIAA, Cathy Chenevey, (703) 264-7574, E-mail: cathyc@aiaa.org; www.aiaa.org

June

JMUM 2001
18-22 Jun 2001
Colorado Springs, Colorado
POC: SURVIAC, Mr. Paul Jeng, (937) 431-2712, E-mail: surviacmodels@bah.com

A New Year
A New Address!

SURVIAC has a new home!

After January 8, 2001 we will be located at:

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